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THE SEGREGATION OF WHITE FIR FOR KILN DRYING

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In the spring of 1959 the Pacific Southwest Forest and Range Experiment Station began a cooperative study of lumber drying with the Winton Lumber Company at its Martell, California, plant. The study was aimed primarily at the drying of commercial white fir which in this area includes both Abies concolor and Abies magnifica. These two species are very similar in properties and are not distinguished in the trade.

The study of lumber drying and quality control of moisture content in kiln dried lumber was divided into several parts. One important consideration in the study was the segregation of white fir lumber on the green chain into homogeneous charges to facilitate kiln operation and to improve the uniformity of the moisture content of the kiln dried lumber. Reported here are the results of a study of the present method of sorting white fir into three sorts--cork, sap, and sinker--as a basis for developing better rules or guidelines for segregation on the green chain.

The problem of segregating white fir into drying sorts consists first of identifying the three distinct types of wood (fig. 1). This is relatively easy. The Western Pine Association has described each type as follows: 3/

> "White fir sapwood is distinguished by its combination of high moisture content, smooth sawing qualities and warm pale tan color.

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3/ Knight, Edwin. Identification of white fir drying sorts. Western Pine Assoc. Research Note No. 4.213, 5 pp. Jan. 15, 1955.

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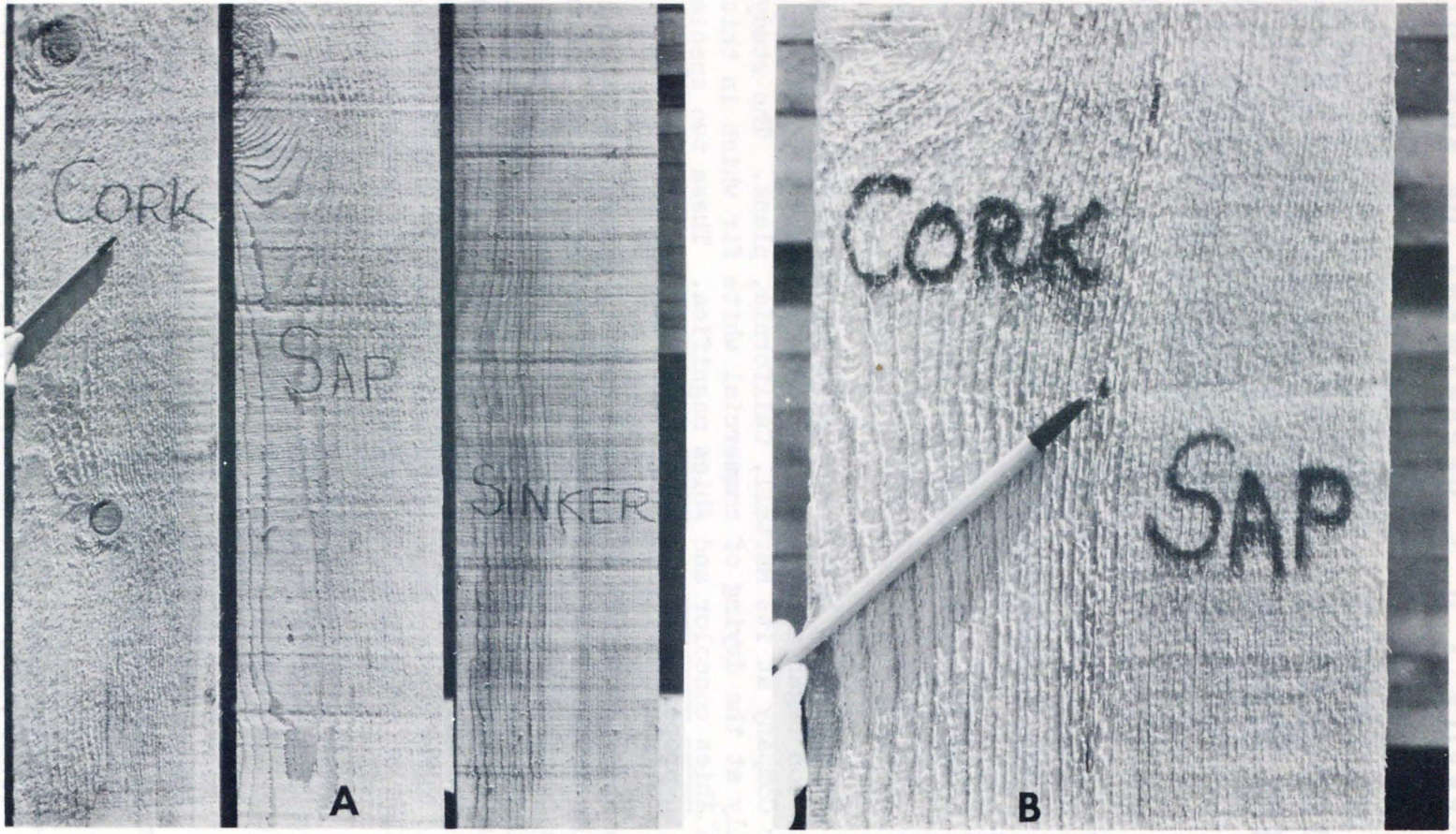

Figure 1.--A, Three types of white fir wood. B, Two types of wood, such as, sap and cork, or sap and sinker, often occur in one board.

"Sinker is also high in initial moisture content. It saws smoothly, but differs in color by being a cold gray, sometimes shaded to mauve or purple.

"Light heart (cork) is low in initial moisture content. It saws roughly at both the head rig and the trimmer. Its color is typically a bluish white, often strikingly bright."

The second and considerably more difficult part of the problem, as this study shows, is to develop and apply rules or guidelines for properly placing individual boards that contain two or more types of wood.

The rules or guidelines now in use differ somewhat from mill to mill. At one mill the rules specify:

1. A piece of lumber that is all or predominantly one type of wood will fall into that sort. It may contain: (a) heavier type wood in an amount less than a strip 1-inch wide running the full length of the piece, or (b) less than a 2-inch wide strip running no more than one-half the full length of the piece, or (c) irregular shaped areas of the heavier type wood amounting to no more than 10 percent of the total area.

2. A piece of wood that contains the heavier type wood in excess of the above limitations will be placed in the heavier sort.

For example, consider a piece of lumber with a mixture of cork and sap-type wood. If the sap portion is in the form of a strip over 1-inch wide running the full length of the piece, it will be considered as sap. If the sap portion is in the form of a strip over 2 inches wide and extends over one-half the length of the piece, it will be considered sap. Similarly, if the sap portion is in the form of irregular areas that extend over 10 percent of the surface, it will also be considered sap.

A similar amount of sinker-type in a board of mixed sap and sinker-type wood or a board of mixed cork and sinker-type wood would be considered sinker.

These rules apply to pieces of all widths. The narrower the piece, therefore, the more refined the segregation can be. And, conversely, the wider the piece the greater the amount of "out-of-place" wood that will be included in the heavier sorts.

The grader gives special consideration to the Shop and Better grades of lumber, in which final moisture content is more critical than in dimension. A borderline piece of Shop and Better would be dried in the heavier segregation to insure adequate drying, whereas a similar borderline piece of dimension grade might be dried in the lighter segregation to prevent overdrying and the attendant degrade and loss of value during subsequent remanufacturing.

Methods

The present commercial segregation of white fir was studied to determine: (1) the green moisture content, and (2) the percent of each of the three types of wood in each sort. These variables were determined by the following procedure.

Ten 1 7/8-inch x 12-inch white fir planks that had been marked in the normal manufacturing procedure for pulling into each of the three sorts (cork, sap, and sinker) were selected at random.

A one-foot section was cut from each end of each plank and marked for identification. From each of these a 1-inch moisture sample was cut at a position 10 to 12 inches from the original plank end. On the end surface of each moisture sample the dividing lines between types of wood were marked with indelible pencil. Each 1-inch moisture sample was then bandsawed along these lines into segments of the different types of wood and the segments were further marked for identification (fig. 2).

Each segment was weighed, oven dried, reweighed, and the moisture content calculated for each division and for the whole one-inch moisture sample. The percent of each type of wood in each segregation was calculated from the oven-dry weights of each segment.

To increase the size of the sample and to determine more accurately the industry practice for white fir segregation, samples from two other mills were included in this phase of the study. Data for all three mills are combined in the results.

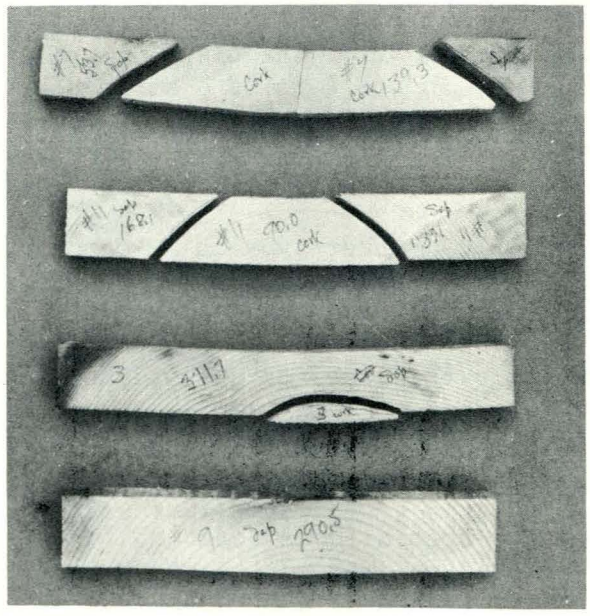

Figure 2.--Sap segregation samples with varying amounts of cork-type wood separated for determining moisture content.

Results

In the present commercial segregation of white fir, each of the three sorts--cork, sap, and sinker--contain some of all three types of wood (table 1). The cork segregation appears to be the most accurate, more than 80 percent of the contents being cork-type wood. Only 59.5 percent of the sap segregation was sap-type wood, and 63.1 percent of the sinker segregation was sinker-type wood.

The range of moisture content of each type of wood in each segregation was also revealing. The moisture content of cork-type wood in the cork segregation was lower than that of cork-type wood in either the sap or sinker segregations. It was highest in the sinker segregation. The moisture content

Table 1.--Moisture content and type of wood in each segregation of white fir--combined sample from three California mills

Segregation and type of wood	Moisture content per sort		Type of wood per sort	
	Range	Average	Range	Average
	Percent	Percent	Percent	Percent
Cork segregation				
Cork wood	58.7-112.6	81.0	79.8-80.6	80.3
Sap wood	58.3-112.5	85.0	0 -20.2	12.9
Sinker wood	109.0-180.0	110.9	0 -19.4	6.8
Weighted average or total	-- --	83.5	-- --	100.0
Sap segregation				
Cork wood	71.3-105.7	88.2	26.1-48.6	36.0
Sap wood	119.2-259.1	170.2	38.0-73.9	59.5
Sinker wood	134.6-159.3	143.4	0 -13.4	4.5
Weighted average or total	-- --	139.5	-- --	100.0
Sinker segregation				
Cork wood	69.2-127.6	102.3	6.1-31.4	15.6
Sap wood	147.6-166.5	156.4	3.6-32.6	21.3
Sinker wood	150.1-167.4	158.1	36.0-90.3	63.1
Weighted average or total	-- --	144.6	-- --	100.0

of the sap-type wood was highest in the sap segregation and lowest in the cork segregation. The moisture content of the sinker-type wood was also highest in the sinker segregation and lowest in the cork segregation.

(The moisture content of each type of wood as determined in preparing kiln samples for the experimental drying of white fir showed even greater variation between the three sorts. This carefully selected material, which can be classed as "pure" sorts, showed a moisture content of 50 to 60 percent for cork, 145 to 180 percent for sap, and 170 to 195 percent for sinker.)

Conclusions

The present commercial segregation of white fir into drying sorts is not clear cut. Each segregation contains some of each type of wood. The inclusion of two or even three types of wood within the same plank precludes 100 percent accuracy. These "mixed" boards should be placed in the segregation that will minimize loss of grade and value during drying and remanufacture.

The moisture content of white fir varies greatly from low moisture content cork-type wood to high moisture content sap and sinker-type wood. However, the moisture content of "out-of-place" wood is more like the segregation in which it is found than the same wood in its proper segregation. Thus, cork-type wood in the sinker segregation has a higher moisture content than cork-type wood in the cork segregation, and sinker-type wood in the cork segregation has a lower moisture content than sinker-type wood in the sinker segregation.

The green moisture content of each type of wood in each segregation is the most important single factor in drying white fir to a uniform final moisture content by commercial kiln schedules now in wide use throughout the range of the species. Improved guidelines for more accurate segregation may be developed from future studies designed to measure the loss of grade and value which results from remanufacturing kiln dried lumber with too high or too low a moisture content.